NASA SBIR/STTR Technologies

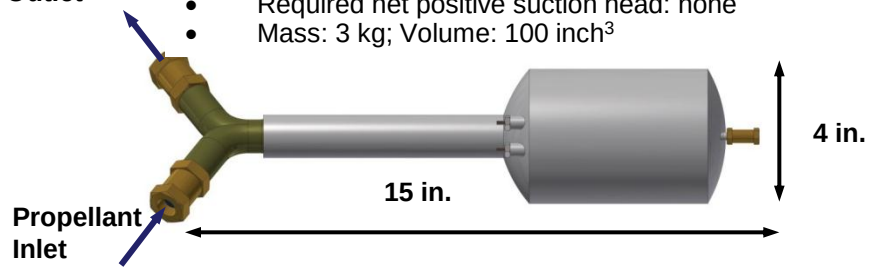
H2.01-9033– A Reliable, Efficient Cryogenic Propellant Mixing Pump With No Moving Parts

PI: Weibo Chen
Creare Inc., Hanover, NH

Identification and Significance of Innovation

- A reliable, efficient, compact propellant mixing pump for cryogenic fluid management applications
  - Prevent thermal stratification to control propellant storage pressure
- Innovative operating mechanism to enable reliable operation at cryogenic temperatures
- Eliminate mechanical pistons or impellers
  - No mechanical wear and vibration
- No pump cavitation problem; self-priming
- High pumping performance
- TRL 3 at start of Phase II, TRL 4 at end of Phase II

- Flow rate: 8 gpm (0.5 L/s)
- Pressure rise: 0.7 psid at P = 20 psia
  - Higher pressure rise is very easy to achieve
- Power dissipated at cryogenic temperature: 5.7 W
  - Efficiency: 45%
- Required net positive suction head: none
- Mass: 3 kg; Volume: 100 inch^3



Phase I Results

- Successfully demonstrated operation with two-phase refrigerant
  - Pressure rise: > 1 psi
  - Volumetric efficiency:~ 50%
- Prototype cryogenic pump design

Phase II Technical Objectives

- Reliable, efficient operation with two-phase cryogen
- High pumping performance
- Lightweight and compact
- High fidelity pump analysis model

Phase II Work Plan

- Develop key components
- Fabricate and test a pump with refrigerant at room temperature
- Design and assemble a cryogenic pump
- Assess cryogenic pump performance with two-phase and sub-cooled cryogen

NASA and Non-NASA Applications

- Zero Boil-Off storage of cryogens
- Short-term vented cryogen storage
- Low-G reliable compression mass gauge
- General cryogenic fluid management and transfer
- Two-phase thermal management systems for military and commercial high power electronics systems

Firm Contact

Weibo Chen, Creare Inc.
wbc@creare.com, 603-640-2425